Soft dentin results in unique, naturally bendable teeth in scraping catfish

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Most South American suckermouth catfishes (Loricariidae) scrape food off substrates, using intensely modified jaws to scrape algae, detritus, and other small food items. The jaws cannot bite or even close the mouth. Teeth demonstrate exquisite rake-like forms, and in some species apparently avoid breaking by bending. The upper jaws, positioned rostral to the lower jaws, pivot around a lowered communal suspension point; lower jaws point medially instead of rostrally, and bear teeth on the ventral side due to evolutionary bone torsion of the jaw bone. As such, all (upper and lower jaw) teeth are exposed to the ventral side of the head. They are swung across the substrate, raking food particles at every adductive strike. Consequently, the teeth experience sideward instead of perpendicular forces, and their shape is well suited for this purpose. In some algae-eating species teeth are only partially mineralized in a proximal zone and can bend (over 90° during experiments), so avoiding breaking too easily. We studied the microstructure and mineralization of the teeth using serial sections, micro-CT scanning, SEM, SEM-EDS and TEM. In the bendable proximal zone of the tooth, very well mineralized, hard material is present in the posterior portion where the tooth experiences compression. Little to no mineralization is recorded (near-absence of Ca and P) in the anterior portion where the tooth material is stretched during feeding. Mineral content determining, using SEM-EDS, proved that the Ca and P content of the posterior (hard) portion exceeds that of the other (not bending) zones of the tooth. Given this stiffness, we discuss the tooth properties taking into account the aspect ratio (length over cross-sectional dimensions), material composition and properties, and biological function. The unique tooth structure can be considered a key transformation in the evolution of the loricariid mode of feeding.